Claims

1. A method for digitizing at least a subarea of the papillary structure of the skin, the subarea defining an intensity profile (IP) with a continuous intensity domain (KI), comprising the steps of:
   - transforming the intensity profile (IP) into at least one analog electrical signal, and
   - transforming said analog electrical signal into at least one digital signal (DS, DS1, DS2) with an intensity domain (A1, A2) consisting of discrete intensity values (W, W1, W2) and a space domain consisting of discrete positions,

   characterized by the steps of
   - repeatedly performing the transforming steps for the same subarea to form a plurality of different digital signals (DS, DS1, DS2), and
   - combining the plurality of digital signals (DS, DS1, DS2) into a common digital papillary structure signal (PS) with an intensity domain (DI) formed from discrete intensity values (W) and a space domain formed from discrete positions in such a way that the intensity domain (DI) of the papillary structure signal (PS) has more intensity values (W) than the intensity domains of each single one of the plurality of digital signals (DS, DS1, DS2).

2. The method according to claim 1, characterized in that the repeated performing of the transforming steps is done for different portions (A1, A2) of the continuous intensity domain (KI) in each case, so that after the combining step the intensity domain (DI) of the digital papillary structure signal (PS) covers a larger portion of the continuous intensity domain (KI) than the intensity domains of each single one of the plurality of digital signals (DS, DS1, DS2).

3. The method according to claim 2, characterized in that upon the repeated performing of the transforming steps, the portions (A1, A2) of the continuous intensity domain (KI) are determined upon transforming the intensity profile (IP) into the analog electrical signal.

4. The method according to claim 3, characterized in that the determination of the second and the further portions is done by means of data of the previous portion or portions.

5. The method according to claim 3 or 4, characterized in that the number of intensity values (W) is determined by the choice or number of portions.

6. The method according to any of claims 3 to 5, characterized in that the transforming of the intensity profile (IP) into an analog electrical signal is done by a capacitive signal converter, and the portion (A1, A2) of the continuous intensity domain (KI) is determined by quantities of charge applied to the capacitors of the capacitive signal converter.

7. The method according to claim 2, characterized in that upon the repeated performing of the transforming steps, the portions (A1, A2) of the continuous intensity domain (KI) are determined upon transforming the analog electrical signal into a digital signal (DS, DS1, DS2).

8. The method according to claim 7, characterized in that the determination of the second and the further portions is done by means of data of the previous portion or portions.

9. The method according to claim 7 or 8, characterized in that the number of intensity values (W) is determined by the choice or number of portions.

10. The method according to any of claims 2 to 5, characterized in that the portions (A1, A2) of the continuous intensity domain (KI) together cover the total continuous intensity domain (KI).

11. The method according to any of claims 2 to 10, characterized in that the portions (A1, A2) of the continuous intensity domain (KI) are adjacent and do not overlap.

12. The method according to any of claims 2 to 10, characterized in that the portions (A1, A2) of the continuous intensity domain (KI) overlap.

13. The method according to any of claims 1 to 12, characterized in that the repeated performing of the transforming steps is done with different numbers of discrete intensity values (W1, W2) of the intensity domains of the digital signals (DS, DS1, DS2) in each case.

14. The method according to any of claims 1 to 13, characterized in that the combining step comprises the following substeps:
    - estimating a discrete intensity value (W) for each discrete position of the digital papillary structure signal (PS) from the respective discrete intensity values (W1, W2) of the accordingly corresponding discrete positions of the digital signals (DS, DS1, DS2), and
    - entering the estimated intensity value (W) at the corresponding discrete position of the digital papillary structure signal (PS).

15. The method according to any of claims 2 to 12 with claim 14, characterized in that the combining step comprises before the estimating and entering substeps the following substep:
    - normalizing the intensity domains of the plurality of digital signals (DS, DS1, DS2) to the portion (A1, A2) of the continuous intensity domain (KI) detected by the respective digital signal (DS, DS1, DS2).

16. The method according to claim 15, characterized in that upon the estimating step, only those discrete intensity values (W1, W2) of the accordingly corresponding positions of the digital signals (DS, DS1, DS2) are taken into account that do not represent a maximum or minimum intensity value (W1, W2) of the respective digital signal (DS, DS1, DS2).

17. The method according to any of claims 14 to 16, characterized in that upon the estimating step, the arithmetic mean of the discrete intensity values (W1, W2) of the accordingly corresponding positions of the digital signals (DS, DS1, DS2) is formed as the discrete intensity value (W) of a discrete position of the digital papillary structure signal (PS).

18. The method according to any of claims 1 to 13, characterized in that upon the repeated performing of the transforming steps, the continuous intensity domain (KI) is mapped to intensity domains of the plurality of digital signals (DS, DS1, DS2) with only two discrete intensity values (W1, W2) in each case, whereby for each of the plurality of digital signals (DS, DS1, DS2) a different threshold value is determined for partitioning the continuous intensity domain (KI) into two subdomains which are each mapped to one of the two discrete intensity values (W1, W2) of each of the plurality of digital signals (DS, DS1, DS2).

19. The method according to claim 18, characterized in that upon the combining step, the plurality of digital signals (DS, DS1, DS2) is added up.

20. The method according to any of claims 1 to 17, characterized in that upon the repeated performing of the transforming steps, digital color signals (DS, DS1, DS2) are produced, and a digital papillary structure color signal (PS) is produced therefrom upon the combining step.

21. An apparatus for digitizing at least a subarea of the papillary structure of the skin, the subarea defining an intensity profile (IP) with a continuous intensity domain (KI), comprising a transformation device (TE) for transforming the intensity profile (IP) into at least one analog electrical signal, and an analog/digital converter (AD) for transforming said analog electrical signal into at least one digital signal (DS, DS1, DS2) with an intensity domain consisting of discrete intensity values (W1, W2) and a space domain consisting of discrete positions, characterized in that the apparatus further comprises:

- a control device (SE) which causes the transformation device (TE) and the analog/digital converter (AD) to produce a plurality of different digital signals (DS, DS1, DS2) for the same subarea, and
- a combination device (KE) which combines the plurality of digital signals (DS, DS1, DS2) into a common digital papillary structure signal (PS) with an intensity domain (DI) consisting of discrete intensity values (W) and a space domain consisting of discrete positions in such a way that the intensity domain (DI) of the digital papillary structure signal (PS) has more dis-

crete intensity values (W) than the intensity domains of each single one of the plurality of digital signals (DS, DS1, DS2).

22. The apparatus according to claim 17, characterized in that
    - the control device (SE) determines in each case different portions (A1, A2) of the continuous intensity domain (KI) of the intensity profile (IP) to be mapped to the intensity domain of the respective digital signal (DS, DS1, DS2), and
    - the combination device (KE) combines the plurality of digital signals (DS, DS1, DS2) in such a way that the intensity domain (DI) of the digital papillary structure signal (PS) covers a larger portion (A1, A2) of the continuous intensity domain (KI) than the intensity domains of each single one of the plurality of digital signals (DS, DS1, DS2).

23. The apparatus according to claim 22, characterized in that a portion (A1, A2) to be mapped of the continuous intensity domain (KI) of the intensity profile (IP) as determined by the control device (SE) is mapped to the analog electrical signal upon transformation of the intensity profile (IP) by the transformation device (TE).

24. The apparatus according to claim 22 or 23, characterized in that the transformation device (TE) is a capacitive signal converter.

25. The apparatus according to claim 22, characterized in that a portion (A1, A2) to be mapped of the continuous intensity domain (KI) of the intensity profile (IP) as determined by the control device (SE) is mapped to a digital signal (DS, DS1, DS2) upon transformation of the analog electrical signal by the analog/digital converter (AD).

26. The apparatus according to any of claims 22 to 25, characterized in that the control device (SE) adjusts the portions (A1, A2) to be mapped of the continuous intensity domain (KI) of the intensity profile (IP) in such a way that they altogether cover the total continuous intensity domain (KI).

27. The apparatus according to any of claims 21 to 26, characterized in that the control device (SE) determines in each case different numbers of discrete intensity values (W1, W2) for the intensity domains of the digital signals (DS, DS1, DS2).

28. The apparatus according to any of claims 21 to 26, characterized in that the combination device (KE) estimates a discrete intensity value (W) for each discrete position of the digital papillary structure signal (PS) from the respective discrete intensity values (W1, W2) of the accordingly corresponding discrete positions of the digital signals (DS, DS1, DS2).

29. The apparatus according to any of claims 22 to 26 with claim 28, characterized in that the combination device (KE), before estimation of the discrete intensity values (W) of the digital papillary structure signal (PS), normalizes the intensity domains of the plurality of digital signals (DS, DS1, DS2) to the portion (A1, A2) of the continuous intensity domain (KI) detected by the respective digital signal (DS, DS1, DS2).

30. The apparatus according to claim 29, characterized in that the combination device (KE), upon estimation of the discrete intensity values (W) of the digital papillary structure signal (PS), takes into account only those intensity values (W1, W2) of the accordingly corresponding discrete positions of the digital signals (DS, DS1, DS2) that do not represent either the maximum or the minimum intensity value (W1, W2) of the particular intensity domain.

31. The apparatus according to any of claims 21 to 27, characterized in that
    - the control device (SE) determines for each of the plurality of digital signals (DS, DS1, DS2) intensity domains with only two discrete intensity values (W1, W2), and determines for each digital signal (DS, DS1, DS2) a different threshold value for partitioning the continuous intensity domain (KI) into two subdomains, for mapping one of the subdomains to in each case one of the two discrete intensity values (W1, W2) of each of the plurality of digital signals (DS, DS1, DS2), and
    - the combination device (KE) adds up the digital signals (DS, DS1, DS2).

32. The apparatus according to any of claims 21 to 30, characterized in that
    - the transformation device (TE) and the analog/digital converter (AD) produce digital color signals (DS, DS1, DS2),
    - the control device (SE) causes the transformation device (TE) and the analog/digital converter (AD) to produce a plurality of different digital color signals (DS, DS1, DS2) for the same subarea, and
    - the combination device (KE) produces a digital papillary structure color signal (PS).